

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**

(12) UK Patent Application (19) GB (11) 2 302 172 (13) A

(43) Date of A Publication 08.01.1997

(21) Application No 9610799.0

(22) Date of Filing 23.05.1996

(30) Priority Data

(31) 9511728

(32) 09.06.1995

(33) GB

(71) Applicant(s)

Crosslee Plc

(Incorporated in the United Kingdom)

Lightcliffe Factory, Hipperholme, Halifax, Yorkshire,
United Kingdom

(72) Inventor(s)

Peter Braybrook

Duncan Ballans

(74) Agent and/or Address for Service

Urquhart-Dykes & Lord

8th Floor, Tower House, Merion Way, LEEDS,
LS2 8PA, United Kingdom

(51) INT CL⁶

F24C 15/06 7/00

(52) UK CL (Edition O)

F4W W57

(56) Documents Cited

GB 2275105 A

GB 2230335 A

GB 1186655 A

GB 1088577 A

GB 0978364 A

GB 0968568 A

GB 0450941 A

GB 0413293 A

(58) Field of Search

UK CL (Edition O) F4W

INT CL⁶ F24C 15/06

(54) Flame simulation apparatus

(57) Flame simulation apparatus, such as might form part of an electric fire, comprises a light source (6), simulated fuel (12) positioned relative to the light source so that light from the light source is visible through the fuel, and a screen (14) positioned behind the simulated fuel, formed from a translucent material. At least one moveable glow element (20) and at least one moveable flame element (16), are made to move by means of a fan (8) so that, when illuminated by light from the light source, the moving glow element creates a moving glow effect in the simulated fuel and the moving flame element creates a flame effect on the screen. The elements (16,20) may be of cardboard covered with reflective foil, or alternatively be of aluminium or stainless steel.

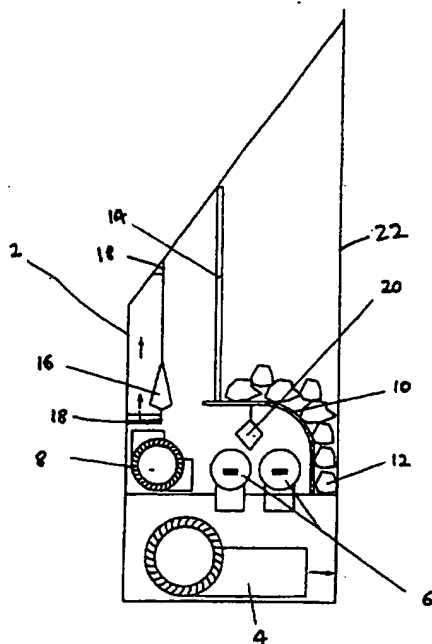


FIG 1

GB 2 302 172 A

1/2

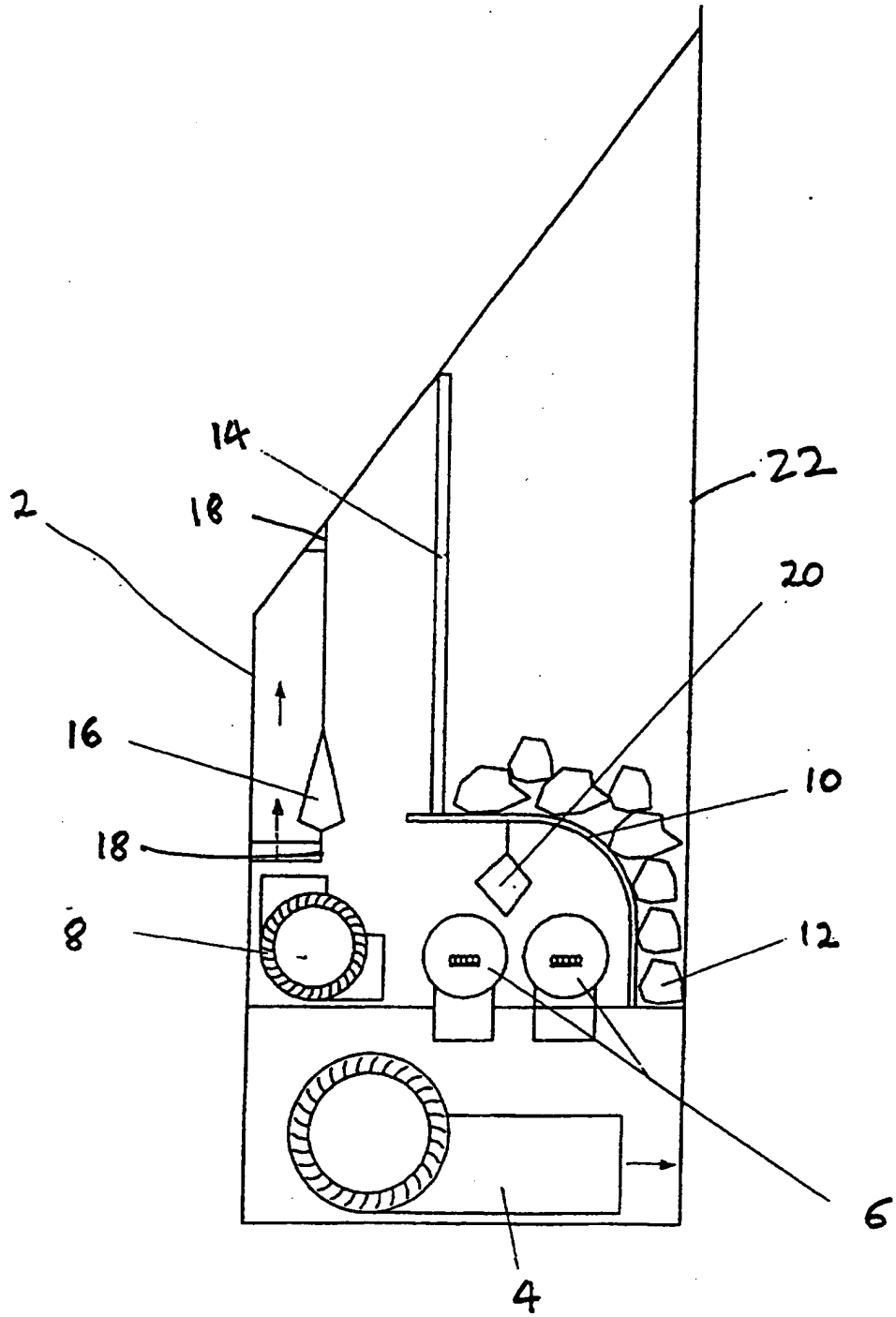


FIG 1

2/2

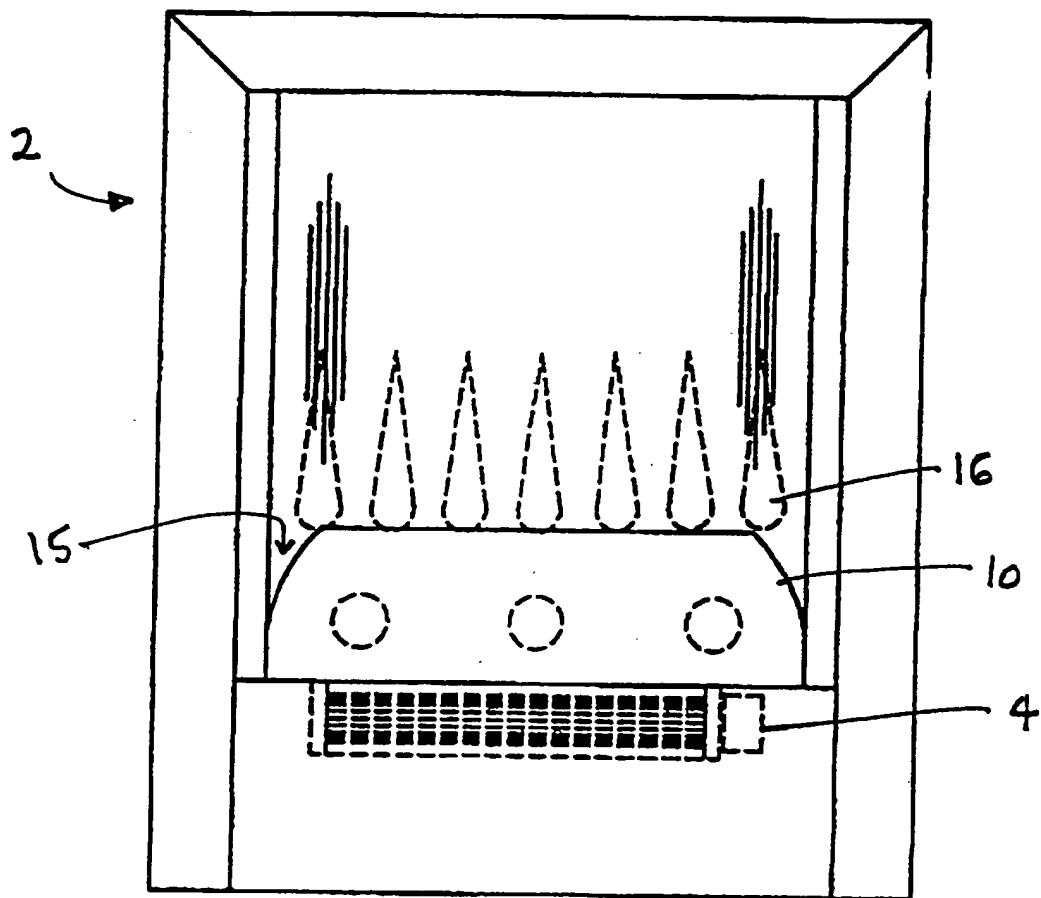


FIG 2

FLAME SIMULATION APPARATUS

This invention relates to flame simulation apparatus. Such apparatus can be included in a heating device which might be powered by an energy source such as electricity or gas and in which it is desired to create an impression of flames such as are created by a solid fuel fire in which a fuel such as coal or logs are being burned.

It is known to create flame effects using a combination of moveable elements located behind a screen which can be caused to move in an air stream, the flame effects arising from shadows or reflections from the moveable elements when illuminated. GB-A-2230335 discloses a heating appliance in which ribbons are suspended behind a screen, itself located behind simulated fuel. The ribbons are subjected to an air flow from a fan, and illuminated by a lamp causing reflections on the screen which give the impression of flames.

The present invention provides flame simulation apparatus in which a combination of glowing fuel and flame effects are provided by appropriately illuminated moving members.

Accordingly, in one aspect, the invention provides flame simulation apparatus which comprises:

- (a) a light source,
- (b) simulated fuel positioned relative to the light source so that light from the light source is visible through the fuel,
- (c) a screen positioned behind the simulated fuel, formed from a translucent material,
- (d) at least one moveable glow element,

(e) at least one moveable flame element, and

(f) means for causing the glow element and the flame element to move so that, when illuminated by light from the light source, the moving glow element creates a moving glow effect in the simulated fuel and the moving flame element creates a flame effect on the screen.

The flame effect and the glow effect can be provided by one or more common elements positioned so that appropriate shadows or reflections or both are cast on the screen and the simulated fuel respectively. However, it will generally be preferred in order to optimise the effects for separate flame and glow effect members to be used, with one or more flame effect members located behind the screen and one or more glow effect members located under the simulated fuel.

The flame effect or the glow element or both can be provided by a member that is suspended so that it can move laterally in an air current. For example, the suspended element can be attached to a surface of the apparatus by means of an appropriate formation such as a clip or hook. The element can be attached directly to the said formation, or indirectly by means of, for example a cord (for example a filament, a wire, a length of string or thread etc). It can be particularly preferred for some applications for the element to be attached by means of a tape or band, which has been found to give rise to suitable movement of the element when exposed to a moving air stream. The tape or band can suitably be made of a reflective material, although non-reflective materials are preferred. A formation for the flame element can be provided on the ceiling of the apparatus or on a wall thereof (for example the back wall or the screen). A formation for the glow element can be provided on the underside of a screen provided as part of or to support the simulated fuel.

A flame or glow element that comprises a suspended member can be supported at opposite ends, for example at the top and bottom of the member respectively. This has the advantage that movement of the member is restricted which can be desirable in order to provide a particular flame or glow effect.

The flame element or the glow element or both can be provided by a flexible material such as a flexible foil or a fabric (for example a woven fabric, a knitted fabric, a non-woven fabric and so on). Preferably, the flame element or the glow element or both is provided by a substantially rigid member, for example with a board or metal element which imparts sufficient rigidity to the member that it does not flex when subjected to air flow or another stimulant to movement.

The shape of the rigid member will be selected according to the particular flame or glow effect that is desired. It has been found that a generally kite-shaped member gives rise to a desirable effect. The member can have openings formed in it to optimise the desired effect, for example a kite-shaped opening or a slit.

The flame element or the glow element will preferably have a surface which is provided by reflective material. The reflective material may be provided on at least part of the surface and, for some applications, over substantially the entire surface of the element. The configuration of the reflective material on the surface of the element will be selected according to the effect which is to be created by the element. The reflective material can be appropriately engraved or otherwise treated so that multi-colour effects are created in light reflected from the surface, for example by diffraction effects.

In addition to reflective material on the moveable elements or instead of it, the apparatus can include surfaces which reflect light from the light source towards the front of the apparatus,

the moveable elements (whether flame elements or glow elements or common elements serving both functions) being positioned between the reflective surface and the front of the apparatus so that shadow or bright patches are created by interaction of the reflected light with the moveable elements as they move.

The simulated fuel will generally be arranged to simulate a solid fuel such as coal or logs. It can be provided by loose fuel members such as loose coal pieces or logs. Generally, such loose fuel members will comprise synthetic material, for example fibrous material as is known. The apparatus can include a translucent support member for the simulated fuel which can be particularly useful when the fuel comprises loose pieces. The support member might comprise, for example, a translucent plastic material with an appropriate colour consistent with the desired glow effect to be created under the fuel.

In another aspect, the invention provides flame simulation apparatus which comprises:

- (a) a light source,
- (b) simulated fuel formed from ceramic fibre material, positioned relative to the light source so that light from the light source is visible through the fuel,
- (c) a support for the simulated fuel formed of translucent material.

The light source preferably comprises one or more electric light bulbs. It can be preferred to use bulbs of different colours to generate a desirable flame or glow effect (or both). For example, it can be preferred to use a combination of white and yellow or orange (or both) bulbs.

The means for causing the glow element or the flame element (or both) to move can comprise a device for generating an air flow, especially a fan. It is however envisaged that the required movement for the glow element or the flame element or both might be caused by convection currents arising from the light source.

Preferably, the screen positioned behind the simulated fuel is curved so that it extends at least partly along the side edges of the simulated fuel as well as along the back of the simulated fuel. This can provide a more realistic flame effect. Preferably, moveable flame elements are provided behind the screen in those portions of the screen located towards or along the side edges of the simulated fuel. Preferably, the apparatus includes means for directing the air flow onto the flame elements so that, when illuminated by light from the light source, the moving flame elements create a flame effect on the screen both directly behind the simulated fuel and in those portions of the screen located towards or along the side edges of the fuel.

In another aspect, the invention provides flame simulation apparatus which comprises:

- (a) a light source,
- (b) simulated fuel positioned relative to the light source so that light from the light source is visible through the fuel,
- (c) a screen positioned behind the simulated fuel, the screen being formed from a translucent material and curved so that it extends at least partly along the side edges as well as along the back of the simulated fuel,
- (d) a plurality of moveable flame element located behind those portions of the screen located behind the

simulated fuel and towards or along the side edges of the simulated fuel, and

(e) means for generating an air flow to cause the flame elements to move, and

(f) means for directing the air flow onto the flame elements so that, when illuminated by light from the light source, the moving flame elements create a flame effect on the screen.

The means for directing the air flow can suitably comprise a baffle. Preferably, the directing means are provided to direct the air flow along the side edges of the simulated fuel towards both of the opposite ends of the screen, for example as two baffles, one for each of the ends of the screen. A baffle when included can be provided by a support for one or more of the moveable elements. This has the advantage of simplifying construction and reducing the number of parts in the apparatus.

The apparatus can include a screen positioned in front of the simulated fuel. The screen will be at least partly transparent so that the fuel and the flame effect and the glow effect provided by the apparatus are visible through it. The screen can be treated so that it is partly reflective. This can provide an impression of greater depth for the flame simulation that is visible through the screen, especially in conjunction with the use of a rear screen (located behind the simulated fuel) which is also partially reflective. The front screen can suitably comprise a toughened glass material.

The flame simulation apparatus of the invention will generally be associated with a heat source. The heat source will generally be powered by electricity, although gas burners may be incorporated for some applications.

The present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a front view of flame simulation apparatus according to the invention,

Figure 2 is a schematic sectional elevation through the flame simulation apparatus shown in Figure 1.

Referring to the drawings, flame simulation apparatus comprises a housing 2 containing a fanned convector heater 4. The housing contains light bulbs 6 and a fan 8. A yellow/orange support 10 formed from a plastics sheet material (for example a methylmethacrylate polymer) is located above the bulbs, on which synthetic coals 12 (not shown in Figure 2) are supported. A screen 14 is positioned behind the synthetic coals. The screen is curved so that it extends at least partly along the side edges 15 as well as along the back of the simulated fuel. The screen is also formed from a plastics sheet material, of a generally darker colour than that of the support 10, for example a brown or black tinted material.

Flame elements 16 are suspended behind the screen 14 by means of threads or non-reflective tapes connected to brackets 18 on the back wall of the housing 2. Threads extend from the top and bottom respectively of the flame elements, to respective brackets, so that the flame elements can move in the air flow generated by the fan 8. The provision of top and bottom threads restricts the movement of the flame elements.

Flame elements are provided behind the screen, both behind those portions of the screen located behind the simulated fuel and towards or along the side edges of the simulated fuel. The lower supports for the flame elements towards the lateral edges of the back wall provide baffles to direct air flowing from the fan towards the flame elements located towards or along the side edges of the simulated fuel.

In similar fashion, glow elements 20 are suspended from the support 10, by means of threads extending from the support to the top of each of the glow elements, so that the glow elements can move in the air flow generated by the fan 8 and as convection currents arising from the light bulbs 6.

Each of the flame elements 18 and the glow elements 20 is sufficiently rigid that it does not flex when subjected to air flow from the fan. They can comprise a rigid cardboard base, covered with a reflective foil over at least part of their exposed surfaces. An alternative material might be for example polished metallic material, such as aluminium or stainless steel.

A front glass screen 22 is provided in front of the simulated fuel, through which the fuel and the simulated flame and glow effects are visible.

CLAIMS:

1. Flame simulation apparatus which comprises:
 - (a) a light source,
 - (b) simulated fuel positioned relative to the light source so that light from the light source is visible through the fuel,
 - (c) a screen positioned behind the simulated fuel, formed from a translucent material,
 - (d) at least one moveable glow element,
 - (e) at least one moveable flame element, and
 - (f) means for causing the glow element and the flame element to move so that, when illuminated by light from the light source, the moving glow element creates a moving glow effect in the simulated fuel and the moving flame element creates a flame effect on the screen.
2. Flame simulation apparatus as claimed in claim 1, in which the moveable flame element comprises a member that is suspended so that it can move laterally in an air current.
3. Flame simulation apparatus as claimed in claim 1, in which the moveable glow element comprises a member that is suspended so that it can move laterally in an air current.
4. Flame simulation apparatus as claimed in claim 2 or claim 3, in which the member is substantially rigid.
5. Flame simulation apparatus as claimed in claim 4, in which the member is substantially kite-shaped.

6. Flame simulation apparatus as claimed in any one of claims 2 to 5, in which the member is supported at opposite ends.
7. Flame simulation apparatus as claimed in any one of claims 2 to 6, in which the member is suspended by means of a tape.
8. Flame simulation apparatus as claimed in any one of claims 1 to 7, in which at least one of the moveable flame element and the moveable glow element has a surface provided by reflective material.
9. Flame simulation apparatus as claimed in any one of claims 1 to 8, in which the means for causing the flame and glow element to move comprises a fan.
10. Flame simulation apparatus as claimed in claim 9, which includes means for directing the air flow from the fan onto the moveable elements.
11. Flame simulation apparatus as claimed in any one of claims 1 to 10, in which the screen is curved so that it extends at least partly along the side edges of the simulated fuel as well as along the back of the simulated fuel.
12. Flame simulation apparatus as claimed in claim 11, in which moveable flame elements are provided behind the screen in those portions of the screen located towards or along the side edges of the simulated fuel.
13. Flame simulation apparatus as claimed in any one of claims 1 to 12, in which a translucent support member is provided for the simulated fuel.
14. Flame simulation apparatus which comprises:

- (a) a light source,
- (b) simulated fuel positioned relative to the light source so that light from the light source is visible through the fuel,
- (c) a screen positioned behind the simulated fuel, the screen being formed from a translucent material and curved so that it extends at least partly along the side edges as well as along the back of the simulated fuel,
- (d) a plurality of moveable flame element located behind those portions of the screen located behind the simulated fuel and towards or along the side edges of the simulated fuel, and
- (e) means for generating an air flow to cause the flame elements to move, and
- (f) means for directing the air flow onto the flame elements so that, when illuminated by light from the light source, the moving flame elements create a flame effect on the screen.

15. Flame simulation apparatus as claimed in claim 14, in which the air flow directing means comprises at least one baffle.

16. Flame simulation apparatus as claimed in claim 15, in which the air flow directing means comprises at least two baffles for directing the air flow along the side edges of the simulated fuel towards opposite ends of the screen.

17. Flame simulation apparatus substantially as hereinbefore described with reference to Figure 1 or Figure 2.



Application No: GB 9610799.0
Claims searched: All

Examiner: Mick Monk
Date of search: 24 July 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.O): F4W

Int CI (Ed.6): F24C 15/06

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2275105 A (BASIC) Flag (17)	1,14 at least
X	GB 2230335 A (BASIC) Reflective ribbons (14)	1,14 at least
X	GB 1186655 (FROST) Flexible material (6)	1,14 at least
X	GB 1088577 (THERMAIR) Flame-shaped strips (27)	1,14 at least
X	GB 978364 (FROST) Flexible strips (11)	1,14 at least
X	GB 968568 (FROST) Example of flicker producing means (5) ; reflector (8)	1,14 at least
X	GB 450941 (GENERAL ELECTRIC) Example of rotatable flicker device (1,2)	1,14 at least

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.

& Member of the same patent family

A Document indicating technological background and/or state of the art.
P Document published on or after the declared priority date but before the filing date of this invention.

E Patent document published on or after, but with priority date earlier than, the filing date of this application.



The Patent Office

13

Application No: GB 9610799.0
Claims searched: All

Examiner: Mick Monk
Date of search: 24 July 1996

Category	Identity of document and relevant passage	Relevant to claims
X	GB 413293 (SMITH) Example of flicker device and glass screen (8)	1,14 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.